THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR...JOHN E. SEMPLE.....

TITLE OF THESIS.CONVENTIONAL VERSUS TELEVISED TEACHING
IN HUMAN GROSS ANATOMY FOR STUDENTS OF
PHYSICAL THERAPY

DEGREE FOR WHICH THESIS WAS PRESENTED.....
MASTER OF EDUCATION

YEAR THIS DEGREE WAS GRANTED.1976.....

THE UNIVERSITY OF ALBERTA

CONVENTIONAL VERSUS TELEVISED TEACHING IN HUMAN GROSS ANATOMY FOR STUDENTS OF PHYSICAL THERAPY

by

JOHN E. SEMPLE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF EDUCATION

DEPARTMENT OF SECONDARY EDUCATION

EDMONTON, ALBERTA

SPRING, 1976

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance a thesis entitled "Conventional versus televised teaching in human gross anatomy for students of physical therapy", submitted by John E. Semple in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

This study investigated the use of closed circuit television and traditional classroom teaching methods of first year students in the physical therapy programme in the Division of Physical Therapy, School of Rehabilitation Medicine, University of Alberta.

The course being studied was Rehabilitation Medicine 202, which is a course in human gross anatomy.

In September 1974, all those students who had entered the programme directly from senior matriculation were given a pre entry test (written) at their first class meeting in the subject area, and then viewed a colour videotape recording of one section of the Rehabilitation Medicine 202 course on four separate occasions.

After the final viewing, the group was given a criterion test (identical to the pre entry test).

In September 1975, a similar group of students was given the same pre entry test at the same point in time of their programme. This group was given the identical information as the experimental group, but using conventional teaching methods only (excluding the use of closed circuit television).

At the end of the same number of hours of instruction as the experimental group had been given,

the control group was given the criterion test (again identical to the pre entry test).

The null hypothesis was that there would be no significant difference between the two groups when comparing the criterion test results.

Since these were similar groups of students but the data was collected on different occasions, it was decided to analyse the data using a two tailed t-test for means for independent samples at the 0.05 level of confidence.

The results showed a significant difference in favour of the television taught group and so the null hypothesis was rejected.

It is suggested that further investigation is needed in order to ascertain whether or not this was an isolated result, or whether more parts of the physical therapy programme should be taught by closed circuit television.

ACKNOWLEDGEMENTS

The author wishes to express his sincere gratitude to Dr K.L. Bowers, under whose advice and guidance this study has been completed. Thanks are also expressed to other committee members:Drs D.J. Engel and K.D. McFadden.

Appreciation is due to the technical staff of the Division of Health Sciences Audiovisual Education, University of Alberta, for their co-operation in the production of the videotape recording used in this study.

Sincere gratitude is also expressed to my wife Janet whose patience and understanding have been tested beyond reason during the completion of this thesis.

TABLE OF CONTENTS

LIST OF TABLES

"We are not merely parts of the future;taken together we are its cause. What tomorrow holds depends on all of us - on what we forsee, on what we believe, and on what we do. And five or ten or twenty years from today we will have only ourselves to praise or blame." (Worth, 1972a).

CHAPTER I

INTRODUCTION

Exposure to television as an information medium has been shown to influence children from even their pre school days, hence the success of such programmes as Sesame Street and Electric Company.

Since high school students entering the first year of a physical therapy programme at university level will have been exposed to much more television viewing than their counterparts of a decade ago, it is possible that the influence on them by television as a teaching tool may be somewhat different from the effect on previous generations of students.

Television format, as used in educational systems, has gone through a number of changes, each of which might be appropriate in its own context.

What then of the future? Worth (1972b) notes that

> "It is not necessary that one must like a futures-forecast; it is only necessary to realize that it could become a future reality. And, like it or dislike it, we must act upon it according to our beliefs and within the scope of reason. Moreover, we must work to alter trends where future consequences appear to be undesirable."

Further, Worth (1972c) goes on to say that

> "One of the most significant changes in future education will be the extent to which technological systems and services will be used, not only in institutions for schooling but also in the home. Technology will provide devices to be employed by teachers as aids to instruction. Students will employ various devices to obtain information and to learn through self-serve techniques."

Television used as a visual medium for teaching, overcomes the difficulty of reaching large groups and allows students to view meticulous detail with unprecedented clarity.

With regard to physical therapy education, it is not intended to replace student laboratory work, but rather to provide a complementary system for further enlightenment.

When deciding to make use of audiovisual media in structuring a basic anatomy curriculum at university level, the problems associated with such a complex and difficult subject to grasp must be recognised, and there must be a genuine desire to want to do something about them. Problems include:

1. Students not being able to see demonstrations properly because of their numbers (it is extremely difficult for a group of forty students to see detail on a small bone for example).
2. It is difficult to relate something on a chalkboard or overhead projector to a real specimen.

3. Due to pressure of time (caused by having to repeat a demonstration a number of times so that every student can see) it is not always possible to answer all of the students' questions.
4. Appropriate media are not always available or suitable to present the material in the way the faculty member wishes.
5. Available material is often outdated and may be expensive to replace if produced commercially.

In consideration of teaching human gross anatomy to students of physical therapy, television may have the greatest flexibility and appropriateness, since there is a need to see depth of tissue movement, to view tissues from changing angles and perspectives, to have magnification and to have stop action. It is also of advantage to be able to add sound or change sound easily without altering the visuals. The videotape recording can be replayed infinitely, with no resources other than a viewing environment and student time.

Audiovisual media may not be the answer to all of the problems. Many researchers have experimented with the use of closed circuit television, though few of these have been in the subject area of anatomy.

Although much of the research does support the use of television as a teaching tool, it is far from conclusive in suggesting that television is superior to

conventional teaching for long term retention. It has however been shown quite clearly that television can allow for a more efficient use of time and faculty, to the ultimate benefit of the student.

CHAPTER II

IMPORTANCE OF THE STUDY

The Problem

At the present time in the School of Rehabilitation Medicine, University of Alberta, the first year basic human gross anatomy courses in the Division of Physical Therapy require a total of eleven direct student contact hours on the part of three faculty members each week.

The courses in question are Rehabilitation Medicine 202 (which is a first term course) and Rehabilitation Medicine 204 (which is a second term course).

In 1975, the faculty members concerned had a combined total of thirty-one years of teaching experience, and were each expected to participate actively in the development and teaching of two proposed graduate programmes in physical therapy. These two proposed programmes would be unique in Canada.

The desire to develop these new programmes, coupled with a relative freeze on the hiring of new academic staff in the university, meant that an extra

demand would be made on existing staff.

Any means of reducing the number of direct student contact hours in the undergraduate programme without reducing the quality of its graduates or the programme itself, would enhance the probability of success of the two graduate programmes.

To the extent that faculty members may be freed to be able to spend more hours on the new programmes, less additional cost would be incurred by the university with regard to academic staff, apart from those already planned for in the normal development of the undergraduate programme.

There have been no new university programmes in physical therapy in Canada since 1967 (although one is under consideration at Memorial University, St. John's Newfoundland).

It is therefore from existing programmes that the teachers and researchers of the forseeable future will come.

To continue teaching the undergraduate courses in the present manner might prove to be hindering to the development of the Division of Physical Therapy. In order to bring about the most effective and efficient use of faculty manpower it might be necessary to alter attitudes and perspectives of the faculty.

Based on the observations of Coffee and Golden (1957), most people are creatures of habit. Innovative ideas and creative activities are not therefore always received with 'open arms', and are in fact frequently viewed with a great deal of suspicion. This is well summed up by Coffee and Golden (1957) who noted that

> "The most significant barrier to institutional change is the resistance which persons express when such change seems threatening to roles in which they have developed considerable security...".

Purpose of the Study

This study attempted to set out a possible method of conveying the present quantity of information in one section of the subject area of human gross anatomy for physical therapy students in their first year of the programme at the University of Alberta, without loss of quality, and allowing for more flexibility of timetabling.

The study investigated whether or not closed circuit television could be used to teach as effectively as conventional methods in a specific unit of the Rehabilitation Medicine 202 course.

Should this be possible, then there might be the opportunity to develop a more flexible timetable than the present one, which might allow for more time to investigate the subject area more deeply.

In addition, if it does not require three faculty members to be involved, a certain amount of time might be utilized in the development of the proposed graduate programmes as well as their future operation.

Limitations

Consideration was given only to the programme of study for first year students of physical therapy at the University of Alberta.

Changes which might be possible at the University of Alberta may not be feasible at other Canadian universities since the School of Rehabilitation Medicine in Edmonton is the only one which is not a part of a Faculty of Medicine or a Faculty of Health Sciences. This autonomy allows for much greater flexibility in both programme planning and programme operation.

Comparison was limited to those students entering the programme directly from grade XII (senior matriculation) in 1974 and 1975.

Only one unit of the Rehabilitation Medicine 202 course was used in the study; that being the unit which was covered in the first three weeks of the course under the title of 'Applied Anatomy'. This section includes the following:

Bony landmarks of the shoulder girdle

Surface markings around the shoulder girdle

Bones of the shoulder girdle.

The experimental group in 1974 was taught this section entirely through closed circuit television. The

control group in 1975 was taught the identical material by conventional methods only (excluding any use of closed circuit television).

Definitions

Gross Anatomy

The courses described in the official University of Alberta calendar under Rehabilitation Medicine 202 and 204, in the Division of Physical Therapy of the School of Rehabilitation Medicine.

Conventional Teaching (of Gross Anatomy)

Didactic lecture

Dissection

Prosection

Demonstration

Self practice.

Closed Circuit Television

This, as defined by Stasheff and Bretz (1968) is:

> "The transmission of a signal through co-axial cables or over a microwave channel, but not broadcast over the air. The term is commonly used to refer to a transmission which stays in the building of origination or is 'piped' to a limited number of specific locations."

CHAPTER III

SELECTED LITERATURE REVIEW

It has been shown by Allen (1967) that the instructional media stimulus relationship to learning objectives is high in learning principles, concepts and rules when using television.

Many studies have been carried out which compare learning from television and conventional instruction. The variety of such studies appears to know few limitations.

However, the various studies are frequently viewed with some reservation since they are extremely difficult to design and conduct due to problems in controlling the vast number of variables. Even such terms as 'conventional instruction' are not easily defined.

Despite all of the inherent problems, many researchers have conducted studies in the hope that television, as a relatively new technology, will be shown to enhance the learning process.

When comparing television learning to more conventional learning, it has been suggested by Chu and Schramm (1967) that there is a problem in making the stimulus comparable in the two groups. It is frequently

the case they suggest, that different teachers are used, hence the researcher cannot be sure whether they are comparing the two methods of instruction or the two teachers.

Giving the experimental group the information at the same time as the conventional group receives the same information will reduce the variables, though the researcher may still not be sure that the content will be the same unless the same teacher administers both.

Distractions are a constant problem, so great care is needed in deciding on the conditions under which learning will take place. Williams, Paul, and Ogilvie (1957) reported that anthropology students who received a lecture in a television studio performed significantly less well not only than a control group which viewed the telecast lecture, but also less well than a group which only heard the same lecture over the radio. It is suggested by the investigators that the reason was because of environmental factors, i.e., distractions in the television studio.

It would seem that researchers in such studies should attempt among other things in their experimental design to try to achieve the following:

Random assignment of subjects (students)

Identical content for lectures

Identical learning environments

Identical performance of the teacher(s)

Identical qualities of teacher if more than one is being used.

That which is ideal and that which is realistic are constantly in the mind of the researcher. Stickell (1963), in a critical review of the methodology and results of research comparing televised and face-to-face instruction, reviewed some two hundred fifty comparisons, yet only ten of these satisfied his criteria for adequate experimental design. In each of the ten, he observed that no significant difference in learning was demonstrated between televised and conventional teaching.

Interestingly, Chu and Schramm (1967) claim that an examination of the majority of less rigidly designed experiments shows the same general findings as with rigidly designed ones, namely, no significant difference. In further support of this concept, Schramm (1962) reviewed three hundred ninety-three experimental comparisons of television versus classroom teaching (including a considerable amount of unpublished material). He reported that of the three hundred ninety-three, two hundred fifty-five showed no significant difference, eighty-three significantly favoured television teaching, and fifty-five

significantly favoured conventional teaching.

In contrast, Pflieger and Kelly (1961), in summarizing the results of a three year study which involved students from eight hundred schools, reported that although most comparisons showed no significant difference, one hundred nineteen were significant in favour of television taught students and forty-four favoured those taught by conventional methods.

A further review by Chu and Schramm (1967) of two hundred seven published studies indicated that of the four hundred twenty-one comparisons made in the studies, three hundred eight showed no significant difference, sixty-three showed television to be superior and fifty found in favour of conventional instruction. This supports the earlier study by Schramm (1962) that comparisons tend to favour television more in the elementary and secondary school levels than at college level.

It may be significant that many of those elementary school students in 1962 are now college level students. Television was probably not a commonplace item in the average home or school until the early 1960's and it may well be that the majority of studies conducted prior to this time should be repeated. The environment in which students were growing up was also somewhat different from that of the

present day.

The technical quality of television has altered considerably since the 1950's. It would seem reasonable to assume that with improvements in the knowledge and understanding of information transfer techniques, the quality of the messages in a sophisticated technology have also improved. Unless this assumption is made, it would have to be said that the process of education had changed very little over the past twenty-five years.

The use of colour as compared with black and white television has received little attention, though a number of studies in this area using cine film have been conducted. Since the quality of colour television has, until recent years, left much to be desired, even studies such as those by Kanner and Rosenstein (1960 and 1961) might possibly produce significantly different results today. In the first of these studies, three hundred sixty-eight army trainees were matched in pairs and assigned to either colour or black and white television presentation. They were tested on each of eleven lessons, with some of the questions on the test designed specifically to judge the influence of colour on learning. Of the eleven, ten showed no significant difference and one favoured colour. In the second experiment, both civilian and military personnel were matched and randomly assigned to either a black

and white or a colour television presentation. Fifteen classes on the subject of guided missiles were shown and the subjects were tested immediately following each class. No significant difference was shown in any of the fifteen. These studies indicate that the use of colour has an insignificant effect on learning and does not appear to be justified in terms of facilitating increased student achievement.

In contrast, Saltz (1963) and Dwyer (1971) conducted studies which were designed to evaluate the realism continuum in visual illustrations (not the colour variable as such) and found that colour was an important variable for improving student achievement of specific learning or educational objectives.

Birren (1959), when investigating the measurable effects that the perception of colour can have on the human organism, noted that colour can influence the cardiovascular, neuromuscular and respiratory systems. Birren further noted that colour is capable of arousing definite emotional reactions, likes and dislikes, as well as pleasant and unpleasant associations.

Whether or not colour is able to command more attention than black and white television may perhaps be judged in part by the Burke Marketing Incorporated (1960) study which investigated the effectiveness of colour television commercials versus the same

commercials shown in black and white. The findings were that the colour commercials received higher ratings and were viewed to their completion by a greater percentage of viewers. In a further study by Gallup and Robinson (1965), it was found that colour prompted an increased recall of viewing the commercial and the viewers were actually able to recall more specific details of the colour commercials than when the same commercials were shown in black and white.

Although colour was felt to be important for a visual landmark location of structures under the skin in the present study, the effect of colour per se was not measured.

With many homes and schools now having colour television, it might be of interest to repeat some of the earlier studies.

In reviewing the literature, there does not appear to be any reference to the question of selective or complete colour blindness.

Many different types of course have been taught by television in schools and colleges. For many years, the basic speech course at Chicago Junior College has been offered entirely through television, and students may choose between this and the same course taught by conventional methods. The television taught students have only two or three meetings on campus during the

academic year. The results show that on average the television taught students do as well at post test as those students taught by conventional methods.

Television has been used as an essential part of many speech courses. This is borne out by Reid (1960), Clevenger and Cobin (1959), and Ivey and De Marco (1961). Each of these studies demonstrated that those students taught in part by television did as well, or better, on post testing than students taught by conventional methods alone. It is further claimed by Reid (1960) that the students began to develop a more positive attitude towards the course.

Many courses involve laboratory work in which the students are expected to work on their own, yet require frequent access to an instructor. Under these conditions, television may not satisfy all of the student needs.

Seibert and Honig (1960) compared television taught and conventionally taught students in a laboratory course in chemistry. In six comparisons, they found only one showed significant difference and that was in favour of the television taught group.

Diamond (1962) studied the effect of closed circuit television upon achievement in the laboratory phase of a functional human anatomy course. The results of this study indicated that although the students did

not produce significantly different results at post test from the conventional laboratory instructional methods, there was some evidence to show that using television as a magnification device within the laboratory is a superior demonstration method for low ability learners. In the majority of course units which Diamond studied, closed circuit television as a magnification device was found to reduce substantially (in some cases by as much as sixty-five percent) the time required by the instructor to present a demonstration for an entire laboratory class.

A wide range of subjects has been taught using closed circuit television at university level. Carpenter (1962) reported on the following courses being taught by this method at Pennsylvania State University:

Introductory Accounting

Cost Accounting

Analytic Geometry

Introductory Anthropology (demonstrations)

Archeology (demonstrations)

Fundamentals of Music Appreciation

History of the United States to 1865

History of the United States since 1865

Modern European History

Psychology of Marital and Home Adjustment

Introductory Sociology

Land Navigation

Elementary Air Science

Intermediate Air Science

Advanced Air Science.

Although many of these studies show no significant difference when compared to conventional teaching, it is perhaps worth noting the wide range in types of course studied, since they range from very theoretical to very practical subjects.

As further evidence of the variety of course which can and has been taught at different academic levels using television, the following are examples.

Sykes (1964) conducted a comparative study on the effectiveness of closed circuit television observation of children's art classes for implementing elementary teachers' training in art education. Random assignment was made to either a television group or a control group using fifty-five education majors. In the study, the television group watched six, forty-five minute art lessons over a period of six weeks, while the control group received the same information by conventional methods. The criterion test showed a significant difference in favour of the television taught group.

Pasewark (1957) carried out a comparative study

on the teaching of typewriting, and demonstrated that the television taught group learned to type significantly faster than the conventionally taught control group.

Kanner, Runyon and Desiderato (1954) compared the teaching of basic military skills by television and conventional methods. The report of their study indicated quite significantly that those taught by television did much better than a control group in five of the seventeen tests administered. In the remaining twelve tests there was no significant difference.

Meacham (1963) studied students in a clothing construction class, and although the television group scored no higher in objective post testing, they did perform significantly better than the control group in their laboratory work.

Herminghaus (1957) compared students in a grade nine class for composition. In this particular study it was the control group which scored significantly higher at post test.

Stake (1959) compared students being taught elementary Spanish vocabulary. Again the control group scored significantly higher than the television taught group at post test.

However, Boone (1954) reported that significantly higher post test scores were achieved by Naval Academy

midshipmen who had received television instruction in electronics, than by the control group.

Macomber (1957) conducted a study using a college human biology course. The results at post test showed significantly in favour of the television taught group.

Three studies which found significantly higher post test scores in the control group, even though they are of varied subject matter, are the Johnson and Harty (1960), Johnson (1960), and Woodward (1964) experiments. These studies were in geometry, introductory geography and biological sciences respectively.

In reviewing the literature, there appears to be a split in the opinions of researchers regarding the value of television teaching against more conventional teaching methods.

Television as an instructional medium has been used in many contexts for a variety of courses. In making the decision to produce a television programme for instructional purposes, there are a number of aspects of production and viewing which might be considered.

Perhaps one of the major problems confronting the planner who wishes to integrate television with conventional teaching methods is co-ordination. After conducting twenty-three studies in eighteen different

countries, Schramm, Coombs, Kahnert, and Lyle (1967) made the following statement:

> "In effect, then, by their very nature the new educational media enter into a kind of team teaching. It is not precisely the kind of teaching usually called 'team teaching' in modern schools, where the term usually refers to the division of specialized responsibilities for a large group of pupils among a group of teachers and assistants. But the principle is the same. Each teacher has a special task which, supposedly, he can do best. In the case of media, a teacher at the point of input, a teacher at the point of reception, perhaps another teacher speaking through textual or exercise materials, combine their efforts, each doing his own part of the task of stimulating students' learning activity. When the media are used for adult education (let us take agriculture as a possible subject area) the teacher at the transmitting end may be an extension specialist, the supervisor at the receiving end may be a forum chairman or village-level worker, and the materials may be prepared by a group at the agriculture research station. But the division of responsibility is the same. Obviously such a division and combination of responsibility requires a clear and common set of learning objectives, the will to work together, careful planning, and adequate training in the special skills required."

Not only must the instructional television programmes be properly integrated into the overall curriculum, but they must of necessity be very carefully planned themselves. There is strong evidence to suggest that learning is increased when there is opportunity for the student to make active responses during the viewing of a programme. This concept is supported by Gropper and Lumsdaine (1961) and the Hagerstown (1959) study.

Even in the absence of clear evidence of the

kind of variations in production techniques which contribute to learning from television, it would appear that students learn better when the visuals are presented in an orderly and carefully planned manner. For example, Cobin and McIntyre (1961) in testing students at college level found that the students preferred simple productions with the minimum of different shots being used.

There is one reported study which showed that significant differences were obtained when using a variety of techniques. This study by Schwarzwalder (1960), compared three different ways of presenting science on television:

1. Visual continuity (with planned camera shots) versus unplanned random selection
2. Visual reinforcement (where superimposed materials were used) versus no superimposed materials. The teacher was in most shots in this section.
3. Manipulation of visuals (either by the studio teacher just as they would in the regular classroom, or by careful planning on the part of both the television production staff and the studio teacher. These two ways were compared).

As might be expected, the post test results were better when there was planned visual continuity, visual reinforcement, and was the result of a co-ordinated

approach by both the production staff and the teacher. Incidently, the same teacher taught all three classes.

Whether or not animation makes any difference to the amount of information transfer is somewhat difficult to assess, since there are very few studies on the subject. Those by Lumsdaine, Sulzer and Kopstein (1951), and Vestal (1952) demonstrated no significant difference. It is perhaps worthy of note that in the Vestal study, students in the upper quarter of ability actually learned more from direct photography with no animation.

In an attempt to maintain the student's attention and to emphasise certain points, some closed circuit television productions have used the technique of making pauses in the tape and asking specific questions of the learner. At first glance this might seem to be a valuable asset. However, the research does not bear this out, since May and Lumsdaine (1958), Kantor (1960), McGuire (1961), and Vuke (1963) all demonstrated either minimal or no gain by the use of the pause for questions.

Whether it be at elementary, secondary or college level, the academic day is spread over a number of hours. This being the case, the question of when to show a television programme should be considered. It might seem reasonable to suggest that the end of the academic day

would not be as effective as the earlier part of the day. Studies by Kraft (1961), Sheehan (1961), Dietmeier (1962), and Amirian (1963) all demonstrated no significant difference between the beginning and the end of the day. In the Amirian study, the students were tested at four and eight months after viewing thirty televised lectures. At both four and eight months there was retention of information.

Student perception of the image is important in learning such subjects as functional and surface anatomy. It is therefore important that the student be able both to hear and see the presentation accurately. The findings of Ash and Jaspen (1953), Kasten (1960), and Hayman (1963) all support this suggestion, although they differ slightly as to the optimum viewing angle. Kasten and Hayman both suggest a forty degree cone while Ash and Jaspen permit a sixty degree cone. The effect of sitting outside the cone can be reduced by the effectiveness of the classroom teacher who is present, according to Gibson (1947). This is achieved by allowing the student to ask questions of the classroom teacher as they arise during the presentation.

There would seem to be no need to have the teacher actually present during instructional television presentations in terms of satisfying the educational objectives for a unit or course. However, although

Klapper (1958), Bryan (1961), Devitt (1961), as well as Head and Philips (1961) support the viewpoint that the presence of the teacher is not essential, Head and Philips suggest that personal contact with the teacher is desirable.

Teaching by television can vary from using a small twelve inch monitor for individual instruction to the large projection systems which are used for large groups in auditoria. There is no evidence to suggest that the size of screen makes any difference to the amount of learning.

Specifically in the area of human gross anatomy, there are only a few reported cases of studies making use of closed circuit television. However, the effectiveness of such studies appears to be more subjective than objective. This is borne out by Markee, Agnello and McFalls (1962), Woolsey, Oppenheimer, Kabisch, Davis and Foster (1956), and Ashton (1966). At Duke University, Markee uses an interesting technique with videotape in gross anatomy. Basic anatomy demonstrations are videotaped and saved until examination time. These are then edited and excerpted, so that in place of the verbal instruction on the original soundtrack, examination questions are recorded, making the examination a part of the student's learning experience.

Although both the University of Alberta and the University of Calgary use fairly extensive amounts of videotape in their respective gross anatomy programmes, there is as yet no available data on comparative studies using more conventional teaching methods as a control. A brief report has been made by Dixon (1969) on the use of television in teaching gross anatomy to medical students at the University of Calgary, but no comparisons are made.

In reviewing the literature it is apparent that many of the studies had deficiencies in their experimental design (mostly due to lack of control over the many variables).

Although no significant difference seems to be the common outcome, it may be that in the final analysis the most appropriate method of instruction is the one which provides the student with the widest variety of learning situations.

It is therefore important to validate course materials so that the appropriate medium for information delivery and transfer is selected. Carpenter (1961) notes that:

> "Successful models are in existence for public school systems, for colleges and universities, for regional and state-wide areas, and for national programs.
> The opportunity now is available for studying them, and adapting them appropriately to areas of need in education."

Perhaps one reason why so little research is to be found outside the 1950's and 1960's is that during that period, a great deal of grant money was made available for these studies since television was a relatively new medium in the educational system. As the research monies for such studies dried up, so attention was directed to other areas.

Although a number of studies were conducted in the period between 1950 and 1970, because of the increased use of and exposure to television, there does appear to be justification for the present study on television instruction versus conventional methods for teaching gross human anatomy to physical therapy students at the University of Alberta. This is in part due to the fact that there are no recorded studies on the subject for physical therapy students, and in part due to the fact that there are few reported studies in the subject area of anatomy.

CHAPTER IV

THE STUDY

Description of Rehabilitation Medicine 202

The official University of Alberta calendars for 1974-75 and 1975-76 describe this course as follows:

REHAB 202. Gross Anatomy I. *3 (First Term, 3-3). Lectures and dissections on the upper limb, supplemented by classes in functional anatomy of this area.

Further detail of the course becomes apparent from the instructional objectives.

Instructional Objectives of Rehabilitation Medicine 202

To aid the student in:

1. Understanding the gross structure of the bones of the upper limb and shoulder girdle
2. Understanding the muscle attachments on the bones of the upper limb and shoulder girdle
3. Understanding the structure and function of the joints of the upper limb and shoulder girdle
4. Understanding the movements of the muscles and joints of the upper limb and shoulder girdle
5. Understanding the formation and distribution of the brachial plexus
6. Understanding the arterial supply and venous drainage of the upper limb and shoulder girdle
7. Understanding the lymphatic drainage of the upper limb and shoulder girdle
8. Understanding the surface markings of the major blood vessels, nerves, bony points, joints and synovial sheathes of the upper limb and shoulder girdle
9. Understanding some of the anatomical 'spaces' of the upper limb and shoulder girdle, i.e., posterior neck triangle, axilla, cubital fossa, and the anatomical 'snuff-box'

10. Understanding the attachments, actions and functions of the muscles of the back
11. Understanding the gross structure of the spinal cord
12. Recognising the relationship between anatomy and kinesiology
13. Developing an awareness of, and a familiarity with, some of the literature in anatomy
14. Developing a knowledge of the vocabulary used in anatomy
15. Developing the skills necessary to carry out a detailed dissection of the upper limb, shoulder girdle and back.

Present System of Teaching Rehabilitation Medicine 202

The present system includes the use of didactic teaching, dissection, prosection, demonstration and self practice.

Teaching the course requires the services of three faculty members for the aforementioned areas, aside from the many hours of individual counselling that students require.

At present, one faculty member lectures to the whole group of forty students for one hour per week as a pre dissection session. One faculty member lectures and demonstrates to half of the group on functional and applied anatomy for two hours per week. In addition, one faculty member lectures to half of the group (twenty students) for two hours each week on gross structure of the appropriate area. While one half are receiving their lecture on gross anatomy, the other half are in the dissection laboratory with two faculty members, dissecting and viewing prosected materials.

Self practice by the students is carried out under supervision in both the functional and applied anatomy sessions and in the dissection laboratory.

During the course of each week, each student receives the following:

One hour of pre dissection lecture

One hour of functional and applied anatomy (in a laboratory setting)

Two hours of lecture on gross structure

Two hours of dissection (in a laboratory setting).

The theory hours on gross structure make use of the overhead projector, thirty-five millimeter slides, chalkboard, real bones (disarticulated), articulated skeleton, laboratory manual, anatomical texts and a variety of handouts prepared by the instructors.

The pre dissection class makes use of the overhead projector, videotape recordings, articulated skeleton, chalkboard, anatomical texts, handouts and the laboratory manual.

Functional and applied anatomy sessions require the use of the chalkboard, surface marking pencils, disarticulated bones, articulated skeleton and a live model (another student from the same group).

During the first three weeks of Rehabilitation Medicine 202 in 1974, the course was scheduled in the following way:

Week 1.... General introduction to anatomy
Anatomical terminology
Gross structure of bones
Gross structure of muscles

Week 2.... The humerus

The scapula and sternum

The clavicle and introduction to the study of muscles

Week 3.... Muscles connecting the shoulder girdle to the trunk

Muscles connecting the arm to the shoulder girdle

The axilla

These first three weeks are entirely theory classes with no attempt to allow any practice on the part of the students. Each student was allocated a set of upper limb bones (disarticulated).

Before viewing the videotape which was used in the study to teach some of the bony landmarks of the shoulder girdle, the students had dealt with the gross structure of each of the bones of the shoulder girdle in theory.

From the end of the third week the course was structured as follows:

Week 4.... Bones of the forearm and wrist

Week 5.... Muscles of the arm

Synovial joints

Week 6.... Shoulder joint

Other joints of the shoulder girdle

Week 7.... Elbow joint

Bones of the hand and fingers

Week 8.... Muscles of the flexor compartment of the forearm

Week 9.... Muscles of the extensor compartment of the forearm

The cubital fossa

Week 10... Muscles of the hand

Radioulnar joints

Week 11... Wrist joint

Other joints of the hand and fingers

Week 12... Muscles of the back

Spinal cord

Week 13... Brachial plexus and its distribution

Vascular system of the upper limb and shoulder girdle

Each of the aforementioned theory classes was held on both Wednesday and Friday afternoons for two hours. Concurrently there were classes in practical dissection, also held on Wednesday and Friday afternoons for two hours each. For one hour each Monday afternoon, a pre dissection class was held to outline what was to be dissected that week, as well as to review the relevant anatomy that had been covered to date. This class also allowed for discussion regarding special techniques of dissection or potential difficulties in dissection and how they might be overcome.

Prosected specimens produced by the laboratory instructors were prepared for the practical sessions in the laboratory. In addition, there are a number of specimens in the anatomy museum for the use of the students.

Following the same week numbers as for the theory classes, the dissection sessions were scheduled in the following way:

Week 4... Pectoral and deltoid regions
Week 5... Axilla
Week 6... Posterior aspect of the shoulder
Week 7... Posterior neck triangle
Week 8... Flexors and extensors of the arm
Week 9... Flexor aspect of forearm
Week 10... Extensor aspect of forearm
Week 11... Muscles of the hand
Week 12... Muscles of the back
Spinal cord
Week 13... Review session for nerves and blood vessels previously dissected.

Concurrently with these sessions are classes in applied anatomy, where the student has certain anatomical information demonstrated to them, which they then repeat on either themselves or on a fellow student. This may take the form of identification of bony features, surface marking vessels or nerves, or putting

various muscles or muscle groups into action.

Corresponding week numbers with course content in applied anatomy are as follows:

Week 4... Pectorals
Deltoid
Latissimus Dorsi

Week 5... Trapezius
Rhomboids
Serratus Anterior
Teres Major and Minor
Subscapularis
Infraspinatus
Supraspinatus
Levator Scapulae
Sternomastoid

Week 6... Bony landmarks of the shoulder region (the sequence was changed so that this section could be taught by videotape recording within the first three weeks, which removed the possibility of contamination from other courses the student might be taking which refer to similar material)

Week 7... Movements of the shoulder joint and shoulder girdle

Week 8... Elbow joint
Cubital fossa

Week 9... Forearm movements

Week 10... Hand movements

Hand function

Week 11... Group action of muscles

Week 12... Synovial sheathes of the hand and wrist

Week 13... Surface marking of:

Axillary artery

Brachial artery

Ulnar artery

Radial artery

Palmar arterial arches

Median nerve

Radial nerve

Ulnar nerve

Superficial venous drainage of the arm and forearm.

As can be seen, the structure of Rehabilitation Medicine 202 is complex and requires a great deal of time on the part of both students and faculty.

Timetabling has of necessity to be fairly rigid due to the many hours of course work and the need to have things done in a certain sequence. Because of this lack of flexibility, any change which can bring about a reduction in the rigidity and a possible freeing of time would be most welcome.

Much of the programme content is structured to

meet the requirements of professional associations for licensing after graduation and therefore cannot be altered or reduced. In addition, since anatomy is the basis of much of the practice of physical therapy, it is essential to maintain a high degree of competence in this area.

Null Hypothesis

That the criterion test results comparing first year students in the physical therapy programme at the University of Alberta who have been taught 'bony features around the shoulder girdle' by closed circuit television, and a control group of similar students, will show no significant difference at the 0.05 level of confidence using a two tailed t-test.

Design of the Study

A comparison was made between first year students enrolled in the physical therapy programme at the University of Alberta taking the Rehabilitation Medicine 202 course in the academic years 1974-75 and 1975-76.

In the academic year 1974-75, a section of the course was taught entirely by closed circuit television instead of by conventional methods.

In the academic year 1975-76, the identical section was taught using conventional methods only.

On their first class meeting in September 1974, those students who had come directly from grade XII (senior matriculation) were given a multiple choice examination as a pre entry test, which is shown as appendix G.

The test was devised by the investigator to assess the competency of the students. The purpose was not to assess their competency to be enrolled in the physical therapy programme, but rather to assess their knowledge of the subject matter to be presented in a particular sub unit of one course. In designing the test, a mark was given for each correct answer, none given for an answer not attempted, and a negative mark for

each answer attempted which was incorrect. In this way it was felt that the opportunity to achieve a high score by simple guesswork or chance was reduced to a minimum.

Had any student been able to achieve the criterion of eighty-five percent accuracy within the twenty minute time period allowed, it would not have been necessary for that particular student to take that sub unit of instruction. The results of this pre entry test are given as appendix B.

Based on the literature review and in line with the purpose of the study, a colour videotape recording was scripted, produced and directed by the investigator, who also appears on the videotape as the teacher. The videotape is available from the investigator.

It was considered by the investigator to be of distinct advantage to be able to see the effects of an axon reflex in the form of an erythema on the skin to indicate structures under the surface. Since this shows as a reddening, it can be seen that colour is required. In addition, since this is only one of a long series of videotape recordings to be made, it is important that all of the series be in colour for visual continuity as well as for the need to view specific colours at different times. For example, it requires red to show arteries, blue to show veins and yellow to show nerves.

The videotape recording produced for the study covered the topic areas of

Bony landmarks of the shoulder girdle

Surface markings around the shoulder girdle

Bones of the shoulder girdle

as required in the course of instruction known as Rehabilitation Medicine 202.

The total duration of the videotape recording was twenty-five minutes, though it was stopped on four separate occasions so that the actual time for instruction was extended to fifty minutes, which is the same as a conventional classroom instruction period.

The four sections were:

1. The individual bones
2. The articulated skeleton (to show the relationship of the individual bones)
3. The articulated skeleton (to show bony features which may be palpated under the skin)
4. The living subject.

At the end of each section the videotape was stopped to allow for student practice on what they had just viewed. Opportunity was afforded the students to handle the bones, the articulated skeleton and the human model during the breaks.

Students in the experimental group viewed the videotape on four separate occasions in order to

simulate normal classroom time. The times selected were

1. September 16th 1974 from 16.00 to 16.50 hours
2. September 18th 1974 from 16.00 to 16.50 hours
3. September 25th 1974 from 16.00 to 16.50 hours
4. September 27th 1974 from 16.00 to 16.50 hours.

Viewing was conducted using two twenty inch Sony 'Trinatron' colour television monitors, with the students arranged in such a way that half viewed each monitor. All sat within a sixty degree cone from the centre of the screen, and no student was permitted to sit more than fifteen feet from the monitor.

The room selected for the experiment was in the Clinical Sciences Building of the University of Alberta because it afforded minimal distraction to the students.

Students were told that their normal classroom was not available in order to minimise any feeling of 'novelty' about the change of location.

The format of the videotape was three quarter inch videocassette (dubbed from a one inch master tape), and was played back on a Sony U-Matic VP-1200 model of videocassette player.

By the time viewing took place, the students had heard many of the terms used on the videotape before and had handled the bones mentioned.

Instructions on the videotape were designed in such a way as to stimulate the student to recall and

reinstate chains of learning which had been previously learned (the chains having a final common link), i.e., why there are borders and surfaces, distal and proximal, medial and lateral, anterior and posterior, and the relationship to other bones.

Following the final viewing, the students were given a criterion test (a repeat of the pre entry test). No warning was given that this would take place and it was given at the beginning of the next regularly scheduled class of Rehabilitation Medicine 202 on September 30th 1974 at 14.00 hours. The results of this test appear as appendix C.

Instructions in the test were designed to elicit the same common link to a stimulus situation belonging to the proper class but to which the student had not previously responded, i.e., where is the suprasternal notch?

The criterion test also checked the verification of the newly learned capability using stimuli to which the student had not acquired specific verbal chains. If these were successful, it is probable that the new concept had been learned.

The condition of reinforcement is also present in concept learning so that contiguity is of importance, i.e., recall some facts about the individual bones of the shoulder girdle before going on to the articulated

shoulder girdle, or identifying the bony points around the shoulder girdle on the articulated skeleton before trying to identify those same points under the surface of the skin on the living subject. This reinforcement was considered in both the design of the videotape and the written test.

In September 1975, the identical pre entry test was given to a similar group of students on their first class meeting in Rehabilitation Medicine 202. The results of this test appear as appendix E.

This group of students was used as the control, and they received all of their instruction over the same number of hours and at the same time of day as did the experimental group in 1974, but using conventional teaching methods only.

At the end of the sub unit, the pre entry test was given again (as the criterion test) in normal class time, with no warning. The results of this test appear as appendix F.

The control group was not taught by the investigator but by another faculty member who normally teaches this material. Discussion had taken place previously to ensure that the control group did in fact receive identical information to the experimental group.

Results

Since these were similar groups of students but were dealt with on separate occasions it was decided to carry out a two tailed t-test for means for independent samples.

TABLE 1

MEAN TEST SCORES

Group	Pre test	Criterion test
Experimental (1974-1975)	-1.70	29.73
Control (1975-1976)	-0.23	11.58

Similarity between the two groups at grade XII (senior matriculation) level may be seen by comparing appendix A with appendix D.

TABLE 2

STATISTICAL DATA FOR TEST SCORES

	Experimental (1974-75)		Control (1975-76)	
	Pre test	Post test	Pre test	Post test
N	30	30	26	26
ΣX	-51	892	-6	301
$\bar{X}$	- 1.70	29.73	-0.23	11.58
ΣX^2	549	26596	36	4251
S	3.99	1.60	1.18	5.54

In the above table, the number of students is shown along the first line (N). Scores for the test on the shoulder girdle, which had a maximum perfect score of thirty-one,, are represented on the second line of the table by the sum of the individual scores (ΣX). The mean or average score ($\bar{X}$) of the two groups, before and after instruction, is shown on the third line. The fourth line shows the sum of the scores squared (ΣX^2) as required in computation of the two tailed t-test. The final line (S) shows the standard deviation of the scores in each group.

A two tailed t-test was carried out for each of the following:

Experimental group and control group at pre test

Experimental group and control group at post test

Experimental group at pre and post test

Control group at pre and post test.

Statistical analysis was carried out according to Ferguson (1971).

Results of Statistical Analysis

Comparing experimental and control groups at pre test:

$t = -1.81$

$p > 0.05$ (not significant at the 0.05 level)

$df = 54$

Comparing experimental and control groups at post test:

$t = 17.12$

$p < 0.001$ (significant at the 0.05 level)

$df = 54$

Comparing experimental group pre and post tests:

$t = 36.98$

$p < 0.001$ (significant at the 0.05 level)

$df = 58$

Comparing control group pre and post tests:

$t = -10.64$

$p < 0.001$ (significant at the 0.05 level)

$df = 50$

In comparing the criterion test (post test) results of the two groups, the null hypothesis that there would be no significant difference at the 0.05 level of confidence was rejected, since there was a very significant difference statistically.

CHAPTER V

SUMMARY AND CONCLUSIONS

The Division of Physical Therapy in the School of Rehabilitation Medicine, University of Alberta, educates graduates who go out into the community to deal with persons who are suffering from some form of physical disability. It is therefore incumbent upon the Division to produce a practitioner of the highest quality. This practitioner must be given the best possible professional education within the constructs of university regulations.

Any instructional system has therefore to make use of available faculty and time. This study set out to investigate whether or not a method other than conventional teaching could be utilized in parts of the physical therapy programme and produce an equivalent result from a learning point of view, but with increased flexibility with regard to timetabling from the present. It is not suggested that, on the basis of the results of this study, teaching by instructional television is superior to any other form of instruction. It is however suggested that certain aspects of the physical therapy curriculum may be taught as effectively by television as by current conventional methods.

Progress towards individualised instruction in

the School of Rehabilitation Medicine has begun. It is therefore only a short term system which has been under investigation in this study.

Although it required moving to a classroom out of the School to view the videotape presentation, it is intended as a long term goal to acquire a learning resources area in the School which would accommodate this type of learning experience.

Approximately six hours of studio time was required to produce the videotape used in the study. Because there were certain scheduling difficulties with the use of the television studio on this occasion, it is anticipated that future productions will require only about one and one half hours. Although scripting does consume a considerable amount of time (the script for this study appears as appendix H), once on the videotape, it does not have to be an annual 'new presentation' as with conventional teaching. The cost of materials (videotape) is relatively small ($18.00 for a half hour videocassette), and once made there is no further production cost as opposed to conventional teaching, where there is the cost of the instructor's salary, as well as an annual increase in that salary from the previous year.

In producing and directing the videotape programme used in the study, the investigator took into

consideration the results of previous research with respect to:

Practice opportunity for students during a programme

Pauses in a programme

Time of day for viewing

Colour versus black and white

Environmental conditions under which learning takes place

Stimulus relationships between television and learning concepts

Co-ordination in presentation

Subjects which can be taught by instructional television

Value of different camera shots in a programme

Value of animation in a programme

Optimum angle for screen viewing

Need for instructor to be present at viewing

Subject area of human gross anatomy.

The present system for teaching Rehabilitation Medicine 202 is very time consuming in respect to faculty, and rigid as far as timetabling is concerned. This affects the ability of the students to take certain elective courses in other parts of the university campus.

After lengthy discussion with the other faculty members concerned with the teaching of this course, it was decided that the unit of applied anatomy under the

title of 'bony features of the shoulder girdle' would be appropriate to put on videotape.

By dividing the programme up in the way chosen, the students had ample opportunity to practice and to review each segment. This gave constant reinforcement with a certain amount of deliberate redundancy.

The results of the pre entry tests in both 1974 and 1975 indicated that no student was ready to go on without this part of the programme being completed.

Following the viewing sessions in 1974 as well as on completion of the identical section taught by conventional methods in 1975, the criterion test (identical to the pre entry test) results showed a significant difference at the 0.05 level of confidence (using a two tailed t-test) in favour of the experimental group. The null hypothesis that there would be no significant difference was therefore rejected.

CHAPTER VI

RECOMMENDATIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Although the total content of Rehabilitation Medicine 202 cannot be altered, the method by which at least parts of it are taught can. This would allow for a more flexible timetable, more time for tutorial type student contact in the subject area of human gross anatomy, more opportunity for faculty to become involved in the development of proposed graduate programmes, or any combination of these. The present system has become too inefficient with respect to utilization of resources.

Worth (1972d) has noted that

> "Nowhere in our system of schooling will the development of responsive learning environments be more traumatic than in higher education. And perhaps nowhere is it more necessary. While there are some notable exceptions, university teaching methods, particularly in undergraduate studies, are disagreeably uniform and tedious. Variable learning environments must be implemented - not only because they cure monotony but also because they allow fit. The uniform learning environment is not much different than most other uniforms; it tends to be either too tight or too loose to suit individual learners and topics. The ill-fitting, tweedy methods of academia are highly resistant to all new tailors. Some sharp needles will be required."

In order to be promoted from first year into second year of the physical therapy programme a student is required to obtain a grade point average of at least

five on a zero to nine scale. In addition, it would be extremely difficult for a student to cope with the second term of the first year unless they had fully grasped the anatomy from the first term.

As was stated earlier in the thesis, anatomy is the basis of much of the practice of physical therapy, so it is essential for the student to have a good working knowledge of the subject.

The nature and usual content of Rehabilitation Medicine 202 has been set out in chapter four.

The long term goals of the physical therapy programme (of which Rehabilitation Medicine 202 is only a very small part), are to educate a therapist who is capable, through the exercise of sound judgement, of planning as well as executing a scheme of treatment, and who is appreciative of the need to provide varied patterns of physical therapy care to suit the needs of varied and changing communities. It is therefore necessary for a physical therapist to be able to plan, conduct and supervise a physical therapy treatment programme.

Since the basic design of the overall programme in physical therapy is structured in such a way as to satisfy the requirements of the profession for membership and licensing, it has not been the purpose of this thesis to suggest a change in the overall

programme, but rather to suggest how at least one part of the curriculum might be changed with respect to its method of instruction.

Although only a small segment of the course was studied, should similar results be forthcoming from other studies on the same course, together with studies of other parts of the physical therapy curriculum, then a serious look would have to be taken at the method of teaching the overall programme.

On the basis of the results of the present study, it is recommended that more investigation be carried out in the area of human gross anatomy teaching by closed circuit television for physical therapy students.

Television appears to be a medium which can allow the instructor to control time, space, perspective, size, distance and perception; it cannot therefore be ignored.

In time, the whole of the physical therapy curriculum should be investigated so that instructional television may take its rightful place in the process of learning, to the ultimate benefit of the people of Alberta.

BIBLIOGRAPHY

BIBLIOGRAPHY

Allen,W.B. Instructional media stimulus relationships to learning objectives. Audiovisual Instruction, 12:1, 1967.

Armirian,G.T. The retention by elementary school children of natural science material and of science attitude and interest changes following a programme of science teaching by television. Dissertation Abstracts, 23:2414, 1963.

Ash,P. and Jaspen,N. Optimum physical viewing conditions for a rear project daylight screen. Technical Report SDC 269-7-37, Instructional Film Research Reports. Port Washington, New York:U.S. Naval Special Devices Center, 1953.

Ashton,E.H. The use of closed circuit television in anatomical teaching. Birmingham University Faculty of Medicine Bulletin, 14:2, 1966.

Birren,F. The effects of color on the human organism. American Journal of Occupational Therapy, 13:125-29, 1959.

Boone,W.F. Evaluation of the U.S. Naval Academy educational television as a teaching aid. Annapolis: U.S. Naval Academy (7010 7-26-54), 1954.

Bryan,E.F. A comparative study in the teaching of high school chemistry and physics. USOE Project No.447, Oklahoma City:Oklahoma State Department of Education, 1961.

Burke Marketing Research Incorporated. Burke color study. Cleveland:AVCO Broadcast Corporation, 1960.

Carpenter,C.R. A commentary on television research 1948-1960. Newer Educational Media, University Park: Pennsylvania State University, 1961.

Carpenter,C.R. The extent of use of closed circuit television for teaching university courses at Pennsylvania State University, 1961-1962. Pennsylvania State University, 1962.

Chu,G.C. and Schramm,W. Learning from television. National Association of Educational Broadcasters, Washington D.C., 4-6, 1967.

Clevenger,T.Jr. and Cobin,M.T. An experiment in open circuit television instruction in the basic course in oral interpretation. Speech Monographs, 26:149-154, 1959.

Cobin,M.T. and McIntyre,C.J. The development and application of a new method to test the relative effectiveness of specific visual production techniques for instructional television. USOE Project No.448, Urbana:University of Illinois, 1961.

Coffee,H.S. and Golden,W.P. In service education, 56th Year Book, Part I. Chicago:National Society for the Study of Education, 101, 1957.

Devitt,J.J. Intellectual stimulation of gifted pupils in small secondary schools through televised instruction. USOE Project No.032, Augusta, Maine: State Department of Education, 1961.

Diamond,R.M. The effect of closed circuit resource television upon achievement in the laboratory phase of a functional anatomy course:a comprehensive investigation of television as a magnification device during laboratory demonstrations. Dissertation Abstracts, 23:884, 1962.

Dietmeier,H.J. The effect of the integration of science teaching by television on the development of scientific reasoning in the fifth grade student. Dissertation Abstracts, 22:3517, 1962.

Dixon,A.D. The place of anatomy in the new Canadian medical school. Canadian Medical Association Journal, 100:13, 611-614, 1969.

Dwyer,F.M. Color as an instructional variable. Audiovisual Communication Review, 19:399-416, 1971.

Ferguson,G.A. Statistical analysis in psychology and education. McGraw-Hill:New York, 152, 1971.

Fritz,J.O. Educational technology. Administrator's Notebook, Midwest Administration Center, University of Chicago, Illinois, 9:6, 1961.

Gallup and Robinson Incorporated. Are color T.V. commercials worth the extra cost? New York Association of National Advertisers, 1965.

Gibson,J.J. Motion picture testing and research. Army Air Force Aviation Psychological Program Research Report No.7, Washington D.C.:U.S. Government Printing Office, 1947.

Gropper,G.L. and Lumsdaine,A.A. An experimental evaluation of the contribution of sequencing, pre-testing, and active student response to the effectiveness of 'programmed' television instruction. Studies in televised instruction, Report No.3, Pittsburgh:Metropolitan Pittsburgh Educational Television Stations WQED-WQEX, and the American Institute for Research, 1961.

Hagerstown:The Board of Education. Closed circuit television:teaching in Washington County 1958-59, March 1959.

Hayman,J.L.Jr. Viewer location and learning in instructional television. Audiovisual Communication Review, 11:27-31, 1963.

Head,S.W. and Philips,C.L. A field experiment in the summertime use of open circuit television instruction to bridge the gap between high school and college. USOE Project No.060, Coral Gables, Florida:University of Miami, 1961.

Herminghaus,E.G. Large group instruction by television: an experiment. School Review, 65:119-133, 1957.

Ivey,S.M. and DeMarco,N. A study of closed circuit television as a teaching technique for speech improvement in the public school system. USOE Project No.278, Fayetteville, Arkansas:Department of Speech and Dramatic Art, University of Arkansas, 1961.

Johnson,G.N. and Harty,F. The Norfolk City experiment in instructional television:the big picture, September 1957-June 1960. Norfolk, Virginia:Norfolk City Public Schools, Educational Television Project, 1960.

Johnson,H.B. A comparative study of an introductory geography course on educational television in the

classroom. Saint Paul, Minnesota:Macalester College, 1960.

Kanner,J.H. and Rosenstein,A.J. Television in army training:color versus black and white. Audiovisual Communication Review, 8:243-252, 1960.

Kanner,J.H. and Rosenstein,A.J. Television and army training:color versus black and white. Audiovisual Communication Review, 9:44-49, 1961.

Kanner,J.H., Runyon,R.P. and Desiderato,O. Television in army training:evaluation of television in army basic training. George Washington University Technical Report 14, Washington D.C., Human Resources Research Office, 1954.

Kantor,B.R. Effectiveness of inserted questions in instructional films. Audiovisual Communication Review, 8:104-108, 1960.

Kasten,D.F. A study of five factors influencing the legibility of televised characters. Dissertation Abstracts, 21:125, 1960.

Klapper,H.L. Does lack of contact with the lecturer handicap televised instruction? Journal of Educational Sociology, 31:353-359, 1958.

Kraft,M.E. A study of information and vocabulary achievement from the teaching of natural science by television in the fifth grade. Dissertation Abstracts, 22:1097, 1961.

Lumsdaine,A.A., Sulzer,R.L. and Kopstein,F.F. The influence of simple animation techniques on the value of a training film. Human Resources Research Laboratories, Report No.24, Washington D.C.:U.S. Air Force Human Resources Research Laboratories, 1951.

Macomber,F.G. et al. Experimental study in instructional procedures. Oxford:Miami University, 1957.

Markee,J.E., Agnello,S.A. and McFalls,F.D. Closed circuit television for examinations in anatomy. Medical and Biological Illustration, 12:1, 1962.

May,M.A. and Lumsdaine,A.A. Learning from films. New Haven:Yale University Press, 1958.

McGuire,W.J. Audience participation and audiovisual instruction:overt-covert responding and rate of presentation. In Lumsdaine,A.A. (ed) 'Student response in programmed instruction', Washington D.C.:National Academy of Science, National Research Council, 417-426, 1961.

Meacham,E.A. The relative effectiveness of face-to-face lecture versus instructional television in a college clothing course. Dissertation Abstracts, 24:276, 1963.

Pasewark,W.R. The effectiveness of television as a medium for learning typewriting. Dissertation Abstracts, 17:579, 1957.

Pflieger,E.F. and Kelly,F.C. The national program in the use of television in the public schools. New York:The Ford Foundation and the Fund for Advancement of Education, 1961.

Reid,J.C. An experimental study of a comparison of content learned, attitude toward subject matter, and attitude toward instructional television of students in a public speaking course presented by television and face-to-face methods. Columbia: Instructional Television, University of Missouri, 1960.

Saltz,E. Compound stimuli in verbal learning:cognative and sensory differentiation versus stimulus selection. Journal of Experimental Psychology, 66:1-5, 1963.

Schramm,W. Learning from instructional television. Review of Educational Research, 32:156-167, 1962.

Schramm,W., Coombs,P.H., Kahnert,F. and Lyle,J. The new media:memo to educational planners. Paris:Unesco and International Institute for Educational Planning, 1967.

Schwarzwalder,J.C. An investigation of the relative effectiveness of certain specific television techniques on learning. USOE Project No.985, Saint Paul, Minnesota:KTCA-TV, 1960.

Seibert,W.F. and Honig,J.M. A brief study of televised laboratory instruction. Audiovisual Communication Review, 8:115-123, 1960.

Sheehan,A.C. The interrelations of interests and attitudes and specific independent variables in the teaching of natural science by television in the fifth grade. Dissertation Abstracts, 21:2855, 1961.

Stake,R.E. The effect of television instruction on individual learning curves. USOE Project No.573 (8190), University of Nebraska, 1959.

Stasheff,E. and Bretz,R. The Television Program, Hill and Wang:New York, 24, 1968.

Stickell,D.D. A critical review of the methodology and results of research comparing televised and face-to-face instruction. Unpublished Doctoral Dissertation, Pennsylvania State University, 1963.

Sykes,R.E. The effectiveness of closed circuit television observation and of direct observation of children's art classes for implementing elementary teachers' training in art education. Dissertation Abstracts, 25:2387, 1964.

Vestal,D.A. The relative effectiveness in the teaching of high school physics of two photographic techniques utilized by the sound motion picture. Abstracts of Doctoral Dissertations, The University of Nebraska, 221-227, 1952.

Vuke,G.J. Effects of inserted questions in films on developing an understanding of controlled experimentation. Dissertation Abstracts, 23:2453, 1963.

Williams,D.C., Paul,J. and Ogilvie,J.C. Mass media, learning, and retention. Canadian Journal of Psychology, 11:157-163, 1957.

Woodward,J.C. Attitude and achievement comparisons for direct and television classes in biological science. Report No.3, Office for the Study of Instruction, Coral Gables, Florida:University of Miami, 1964.

Woolsey,F.M., Ruhe,D.S., Oppenheimer,M.J., Kabisch,W.T., Davis,G.D. and Foster,J.E. The use of television in teaching physiology and anatomy. Journal of Medical Education, 31:2, 138-144, 1956.

Worth,W.H. A choice of futures. Report of the Commission on Educational Planning, Queen's Printer for the Province of Alberta, Introduction, 1972a.

Worth,W.H. A choice of futures. Report of the Commission on Educational Planning, Queen's Printer for the Province of Alberta, 1, 1972b.

Worth,W.H. A choice of futures. Report of the Commission on Educational Planning, Queen's Printer for the Province of Alberta, 16-17, 1972c.

Worth,W.H. A choice of futures. Report of the Commission on Educational Planning, Queen's Printer for the Province of Alberta, 202, 1972d.

APPENDIX A

GRADE XII MARKS OF STUDENTS ENTERING THE PHYSICAL THERAPY PROGRAMME IN 1974

APPENDIX A

Grade XII final average (five subjects) of students entering the physical therapy programme in September 1974.

Student	Mark
1.	74.6%
2.	84.2%
3.	77.6%
4.	70.2%
5.	94.6%
6.	87.6%
7.	88.0%
8.	78.8%
9.	82.0%
10.	77.6%
11.	77.4%
12.	78.8%
13.	77.6%
14.	81.0%
15.	89.8%
16.	81.2%
17.	76.8%
18.	86.4%
19.	72.4%
20.	87.0%
21.	82.0%
22.	80.2%
23.	79.0%
24.	80.6%
25.	83.2%
26.	95.0%
27.	80.1%
28.	80.6%
29.	83.7%
30.	91.3%
Mean	81.98%

APPENDIX B

PRE ENTRY TEST RESULTS FOR THE EXPERIMENTAL GROUP:1974-1975 ACADEMIC YEAR

APPENDIX B

Pre entry test results for the experimental group: 1974-1975 academic year.

Student	Score out of 31
1.	-21
2.	1
3.	0
4.	- 2
5.	0
6.	0
7.	- 6
8.	0
9.	- 3
10.	- 4
11.	- 2
12.	- 1
13.	0
14.	0
15.	- 1
16.	0
17.	1
18.	0
19.	- 1
20.	0
21.	0
22.	0
23.	- 4
24.	- 2
25.	0
26.	0
27.	- 1
28.	0
29.	- 2
30.	- 3
Mean	- 1.70

APPENDIX C

CRITERION TEST RESULTS FOR THE EXPERIMENTAL GROUP:1974-1975 ACADEMIC YEAR

APPENDIX C

Post test (criterion) results for the experimental group:1974-1975 academic year.

Student	Score out of 31
1.	28
2.	30
3.	31
4.	31
5.	31
6.	30
7.	28
8.	29
9.	29
10.	30
11.	24
12.	28
13.	31
14.	30
15.	29
16.	31
17.	31
18.	27
19.	30
20.	30
21.	31
22.	28
23.	31
24.	31
25.	30
26.	30
27.	31
28.	31
29.	31
30.	30
Mean	29.73

APPENDIX D

GRADE XII MARKS OF STUDENTS ENTERING THE PHYSICAL THERAPY PROGRAMME IN 1975

APPENDIX D

Grade XII final average (five subjects) of students entering the physical therapy programme in September 1975.

Student	Mark
1.	81.4%
2.	86.0%
3.	83.0%
4.	82.4%
5.	81.4%
6.	80.9%
7.	82.8%
8.	85.8%
9.	89.6%
10.	84.6%
11.	84.2%
12.	83.2%
13.	83.0%
14.	84.8%
15.	80.2%
16.	80.6%
17.	81.4%
18.	84.0%
19.	83.2%
20.	81.6%
21.	83.2%
22.	83.8%
23.	88.0%
24.	92.4%
25.	79.6%
26.	82.4%
Mean	83.60%

APPENDIX E

PRE ENTRY TEST RESULTS FOR THE CONTROL GROUP:1975-1976 ACADEMIC YEAR

APPENDIX E

Pre entry test results for the control group:1975-1976 academic year.

Student	Score out of 31
1.	0
2.	0
3.	0
4.	-1
5.	2
6.	0
7.	-1
8.	-2
9.	0
10.	0
11.	0
12.	0
13.	0
14.	-2
15.	-3
16.	0
17.	0
18.	2
19.	-1
20.	0
21.	0
22.	-2
23.	0
24.	2
25.	0
26.	0
Mean	-0.23

APPENDIX F

CRITERION TEST RESULTS FOR THE CONTROL GROUP:1975-1976 ACADEMIC YEAR

APPENDIX F

Post test (criterion) results for the control group: 1975-1976 academic year.

Student	Score out of 31
1.	19
2.	10
3.	15
4.	8
5.	9
6.	7
7.	9
8.	10
9.	22
10.	0
11.	22
12.	10
13.	10
14.	11
15.	13
16.	19
17.	12
18.	8
19.	7
20.	15
21.	14
22.	14
23.	17
24.	12
25.	8
26.	0
Mean	11.58

APPENDIX G

PRE ENTRY AND CRITERION TEST

APPENDIX G

Pre entry and criterion test

Division of Physical Therapy,
School of Rehabilitation Medicine,
University of Alberta. Time allowed:20min.

REHABILITATION MEDICINE 202..... APPLIED ANATOMY

ALL questions to be answered. Please circle the correct answer in each case. A mark will be deducted for each incorrect answer given, though none will be deducted for questions not attempted.

****

1. The clavicle is:
   a. a long bone
   b. a short bone
   c. a flat bone
   d. an irregular bone
   e. none of these.

2. The medial extremity of the clavicle is:
   a. more rounded than the lateral extremity
   b. similar to the lateral extremity
   c. more roughened superiorly than the lateral extremity
   d. non articular
   e. none of these.

3. The clavicle is convex:
   a. anteriorly in its lateral one third
   b. anteriorly in its medial one third
   c. anteriorly in its middle one third
   d. anteriorly throughout its length
   e. anteriorly in its lateral half.

4. The lateral one third of the clavicle is:
   a. smooth inferiorly
   b. rough inferiorly
   c. articular
   d. smooth superiorly and inferiorly
   e. none of these.

5. The acromion process is on the:
    a. sternum
    b. clavicle
    c. scapula
    d. seventh cervical vertebra
    e. humerus.

6. The acromion process has:
    a. 1 border
    b. 2 borders
    c. 3 borders
    d. 4 borders
    e. 5 borders.

7. The acromion process is flattened:
    a. antero-posteriorly
    b. medio-laterally
    c. supero-inferiorly
    d. antero-laterally/postero-medially
    e. none of these.

8. The distance from the tip of the acromion process to the acromio-clavicular joint in the adult is approximately:
    a. a half inch
    b. three quarters of an inch
    c. one inch
    d. one and one quarter inches
    e. one and one half inches.

9. The acromio-clavicular joint is the approximation of the lateral part of the clavicle with:
    a. the medial border of the acromion process
    b. the lateral border of the acromion process
    c. the posterior border of the acromion process
    d. the anterior border of the acromion process
    e. the inferior border of the acromion process.

10. The lesser tuberosity is on the:
    a. scapula
    b. humerus
    c. clavicle
    d. sternum
    e. none of these.

11. The lesser tuberosity faces:
    a. anteriorly
    b. posteriorly
    c. medially
    d. laterally
    e. inferiorly.

12. The greater tuberosity is on the:
    a. scapula
    b. humerus
    c. clavicle
    d. sternum
    e. none of these.

13. The greater tuberosity faces:
    a. antero-laterally
    b. antero-medially
    c. postero-laterally
    d. postero-medially
    e. superiorly.

14. The distance from the margin of the acromion process to the greater tuberosity in the adult is approximately:
    a. one half inch
    b. three quarters of an inch
    c. one inch
    d. one and one half inches
    e. two inches.

15. The distance from the margin of the acromion process to the lesser tuberosity in the adult is approximately:
    a. one half inch
    b. three quarters of an inch
    c. one inch
    d. one and one half inches
    e. two inches.

16. Between the greater and lesser tuberosities lies:
    a. the spiral groove
    b. the foramen magnum
    c. the intertubercular sulcus
    d. the coronoid fossa
    e. none of these.

17. The shoulder joint is more correctly known as the:
    a. acromio-humeral joint
    b. sterno-humeral joint
    c. coraco-humeral joint
    d. gleno-humeral joint
    e. claviculo-humeral joint.

18. The shoulder joint is the approximation of the:
    a. head of the humerus and the pterygoid fossa
    b. head of the humerus and the olecranon fossa
    c. head of the humerus and the coronoid fossa
    d. head of the humerus and the glenoid cavity
    e. head of the humerus and the buccal cavity.

19. The coracoid process faces:
    a. antero-medially
    b. postero-medially
    c. postero-inferiorly
    d. antero-laterally
    e. supero-laterally.

20. The spine of the scapula is:
    a. on its medial border
    b. continuous with the acromion process
    c. continuous with the coracoid process
    d. on its inferior angle
    e. on its superior border.

21. From lateral to medial, the spine of the scapula passes:
    a. inferiorly and medially
    b. superiorly and medially
    c. anteriorly and medially
    d. posteriorly and medially
    e. directly medially.

22. The superior border of the scapula cannot be palpated because:
    a. there is too much fibrous tissue
    b. there is too much fatty tissue
    c. it is too thin
    d. too many bony structures prevent it
    e. there are too many muscular structures.

23. The scapula has:
    a. 1 border
    b. 2 borders
    c. 3 borders
    d. 4 borders
    e. 5 borders.

24. The junction of the medial and lateral borders of the scapula is known as:
    a. the superior angle
    b. the inferior angle
    c. the lateral angle
    d. the anterior angle
    e. the posterior angle.

25. The scapula lies on the chest wall of the adult between the:
    a. first and fifth ribs
    b. second and seventh ribs
    c. third and ninth ribs
    d. fourth and sixth ribs
    e. fifth and eigth ribs.

26. The lateral angle of the scapula is known as the:
    a. olecranon fossa
    b. coronoid fossa
    c. glenoid fossa
    d. acromion fossa
    e. coracoid fossa.

27. The scapula has:
    a. 1 surface
    b. 2 surfaces
    c. 3 surfaces
    d. 4 surfaces
    e. 5 surfaces.

28. The supraspinous fossa of the scapula is on the:
    a. superior surface
    b. inferior surface
    c. anterior surface
    d. posterior surface
    e. medial surface.

29. The sternal notch is located:
    a. on the sternal end of the clavicle
    b. at the second sterno-costal junction
    c. on the body of the sternum
    d. between the sternal ends of the clavicles
    e. on the anterior surface of the manubrium of the sternum.

30. The sternal angle is located:
    a. at the level of the second costal cartilage
    b. at the level of the third costal cartilage
    c. at the level of the seventh costal cartilage
    d. three inches inferior to the sternal notch
    e. six inches inferior to the sternal notch.

31. The sternal angle may not be palpated because of:
    a. excessive muscle tissue
    b. excessive fatty tissue
    c. excessive fibrous tissue
    d. the position of the breast
    e. none of these, since it may be palpated very easily.

APPENDIX H

VIDEOTAPE SCRIPT

APPENDIX H

Script for the videotape used in the study

"This programme will deal with the bony features around the shoulder region. Many of these features may be palpated through the skin on the living subject.

In order to refresh our memories, let's review some of the bones which we have met previously.

First, the scapula. You will remember that the scapula is a flat bone, and that it has three borders and two surfaces. The borders are, the vertebral border on the medial side, the lateral border on the axillary side, and the superior border.

The anterior is known as the subscapular fossa, and the posterior is divided into two by the spine of the scapula. The spine divides or separates the infraspinous fossa from the supraspinous fossa.

We look now at the angles. There is a superior angle which is sharp and joins the superior border with the medial border. There is an inferior angle which joins the medial and lateral borders inferiorly, and there is a thick truncated lateral angle, but referred to as the glenoid cavity.

On the posterior surface of the scapula is the large prominent spine, ending in an enlargement known

as the acromion process. The spine is sharp and the acromion process is flattened supero-inferiorly.

On the anterior aspect, projects the coracoid process. The coracoid process faces forwards and laterally.

Joining onto the scapula is the clavicle. The clavicle is a long bone with expanded extremities. The medial extremity is somewhat more rounded than the lateral, which is very flattened and very roughened inferiorly. It is curved sinuously, so that the lateral extremity projects forwards.

The clavicle articulates with the acromion process of the scapula - so. We'll see these later on the skeleton. The junction of these two bones - where my thumb is - is known as the acromioclavicular joint.

The other bone which enters into this junction or union in the shoulder girdle is the humerus. The humerus has at its upper extremity a large rounded head, and anteriorly and laterally there are two projections - the lesser tuberosity, which projects directly anteriorly, and the greater tuberosity, which projects antero-laterally. Between these two tuberosities lies a deep groove. This groove is known as the bicipital groove or intertubercular sulcus, and in it lies the tendon of the long head of the biceps muscle.

The upper part of the humerus articulates with

the scapula so that the articular surface of the head of the humerus articulates with the glenoid cavity - the glenoid fossa - so. This junction is known as the glenohumeral joint.

Together, the three bones form a functional unit of the shoulder girdle.

Let's have a look at those, articulated now on the skeleton.

Here now are the articulated bones we have been talking about which comprise the shoulder girdle. Let's just review the actual surfaces, borders and bony landmarks on those bones before trying any measurements or any surface markings as such.

First the clavicle, with its long shaft, its expanded medial and lateral extremities - the medial extremity being somewhat more rounded than the flattened lateral. The lateral extremity of the clavicle articulates with the acromion process of the scapula. This junction is known as the acromioclavicular junction or acromioclavicular joint.

The acromion process has four borders and two surfaces. It has a medial, an anterior, a lateral and a posterior border, with a superior and an inferior surface. It is the medial border which takes part in the acromioclavicular junction or union.

The spine of the scapula is somewhat sharpened

on its superior border and on its inferior border, and the spine ends at the medial extremity as an enlargement in the shape of a smooth triangle. This is smooth due to the action of muscle crossing over it.

The scapula has three borders, a lateral border or axillary border, a medial border or vertebral border, which come together at the inferior angle, a superior border - let's see if we can have a good look at that - a superior border which joins the medial border at the superior angle, and the truncated lateral angle at the junction of the lateral and superior borders - which is not referred to as an angle but as the glenoid cavity.

The glenoid cavity faces laterally, slightly anteriorly and slightly inferiorly - laterally, anteriorly and inferiorly. The smooth articular surface, which is pear shaped, articulates with the head of the humerus - the large articular head of the humerus - as the glenohumeral junction or shoulder joint.

Also on the upper extremity of the humerus, if we put the arm in the anatomical position, the lesser tuberosity of the humerus projects directly anteriorly. Immediately lateral to it is a deep groove for the tendon of the long head of biceps. This is known as the intertubercular sulcus or bicipital groove, and lateral to the groove is the larger greater tuberosity of the humerus.

Also projecting anteriorly is the coracoid process, projecting from the lateral angle. The coracoid process of the scapula faces forward (anteriorly) and laterally.

If we move along the clavicle to its medial end we come to see a notch between the medial ends of both clavicles. This is known as the suprasternal notch - so called because it lies above this bone - the sternum.

The sternum is divided up into three parts. The upper part to here, is known as the manubrium. From here down to this point is known as the body, and the terminal portion is known as the xiphisternum. Going back to the manubrium, the upper part, at the junction of the manubrium with the body of the sternum, there is also a junction with a pair of ribs. These are the costal cartilages of the second ribs - there is the first rib and there is the second rib.

It is very difficult in the human subject to palpate the first rib since it is down in the root of the neck, here, and it is underneath the medial end of the clavicle at this point.

Therefore, if you wish to count the number of ribs for any landmarks, it is necessary to find this junction, which is known as the sternal angle, and beside it the second costal cartilages - then you can work up or down from that point.

From this sternal angle it is also possible, if we follow the second rib around, to find the level that the scapula sits on the rib cage. It sits between the second and the seventh ribs - a useful bony landmark to know.

Before going on to look at these various bony landmarks on the human body, at this point we will stop the tape to give you the opportunity to review the bony points, the articular surfaces and other features of the bones which comprise the shoulder girdle.

Back now to the articulated skeleton, let's have a look at some of the structures which can be palpated underneath the surface of the skin in a living subject, and identify some of the bony features which can be measured under the surface of the skin.

The clavicle can be palpated throughout its entire length from medial to lateral. The acromioclavicular joint can be palpated and will be found approximately one and one half inches medial to the tip of the acromion process - one and one half inches medial to the tip of the acromion process - the acromioclavicular joint running antero-posteriorly.

The acromion process may be palpated around its margins, and the palpating finger may then be run down the spine of the scapula almost throughout its length. It will not be possible to feel the medial end of the

spine due to muscles acting over this point.

The sharp medial border of the scapula may be palpated from superior down to inferior angle. It will be more difficult in the upper part again due to bulk of muscle over this area, but it should be possible to feel at least the lower two thirds or three quarters of the medial or vertebral border, down to the inferior angle.

With the arm hanging at the side you will note that the inferior angle lies at the level of the seventh rib.

The lateral border is thicker than the medial, and again may be palpated in its lower three quarters. Sometimes in the thin subject it is possible to feel almost to the glenoid cavity, but it is much thicker to palpate along the margin of the axilla than is the sharpened medial border.

It is not possible to feel the superior border due to the muscular structures in the area.

On the anterior aspect of the shoulder, it is possible to palpate the lesser and greater tuberosities. The lesser tuberosity will be found approximately one and one half inches below, or distal to the acromion. The greater tuberosity, much larger to feel, will be found approximately half an inch from the acromion process - this does not appear so on the skeleton but

remember this is artificially mounted. The distance from the acromion to the greater tuberosity is approximately half an inch, the distance from the acromion to the lesser tuberosity approximately one and one half inches.

The lesser tuberosity is very sharp, pointing directly anteriorly. Between the two tuberosities you may be able to roll the tendon of the long head of biceps.

The coracoid process is palpable in a line with the junction of the middle and lateral thirds of the clavicle. If you find the junction of the middle and lateral thirds of the clavicle, and the approximately again one and a half inches distal to this, inferiorly and slightly laterally, you will find the tip of the coracoid process - a little tender if you press hard.

The shoulder joint - the actual articular surface of the shoulder joint - is often regarded as a convex medially curved line from the acromioclavicular joint, downwards for a distance of three or four centimeters.

In the mid line, the distance we need to know is the distance from the suprasternal notch to the sternal angle. This is a distance of approximately one and three quarter inches.

These bony features and palpable structures will

help us to identify the same structures through the skin on the living subject.

Before doing so however, we will stop the tape again to give you the opportunity to review what we have just said on the articulated skeleton.

Here now is the living body. Let's see if we can identify some of the structures that we met on the skeleton earlier.

First the suprasternal notch, and one and three quarter inches distal to that, the sternal angle. Between them we can feel the clavicle, and we can palpate the clavicle throughout its length towards the point of the shoulder.

Right at the tip of the shoulder we can feel a bony prominence. This bony prominence is the margin of the acromion process, and, one and one half inches medial to that, is the acromioclavicular joint.

If we follow around posteriorly from the acromion process, it is possible to feel all the way down the spine of the scapula. You will notice that my finger is passing downwards, backwards and medially - and at this point, I have reached the margin of the scapula. Above this point I cannot feel the medial border due to muscular mass. Below this, I can trace down the medial border of the scapula - and now my finger is starting to go around, so this is the inferior

angle - at the level of the seventh rib.

The axillary border is deep and requires much more pressure to palpate, and in this subject, may be palpated as far as the posterior margin of the axilla.

Returning now to the anterior aspect of the shoulder - from the anterior margin of the acromion process, we find the acromioclavicular joint, and a line which is convex medially from there over a distance of three or four centimeters, gives us an approximation of the position, under the surface, of the glenohumeral joint.

We move back medially along the clavicle to the junction of the middle and lateral one thirds, come down approximately an inch and a half, and press - we come to the tip of the coracoid process.

From the lateral margin of the acromion process it is possible to feel the greater tuberosity of the humerus. It is approximately one half inch distal to, and slightly anterior to, the tip of the acromion process. Medial to this we find the lesser tuberosity - and between them the groove for the tendon of the long head of biceps.

All these points are readily palpable on the living subject, and we will stop the tape again to give you the opportunity to identify these markings on your own model.

We have just looked at some of the bony structures of the shoulder region. These have included the clavicle, the scapula, the humerus and the sternum.

Before going on to look at the next programme, you should review these structures on the articulated skeleton. You should also be able to identify each of these structures by palpation and by marking on the living subject."

The actual programme may be viewed on the half inch format colour videotape which accompanies this thesis.